Stoller
Hanford Office
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HGLP-LDR-076

299-E33-18 (A4844)
Log Data Report

Borehole Information:

Borehole:	299-E33-18 (A4844)		Site:	216-B-7A & B Cribs	
Coordinates (WA St Plane)		GWL[1] (ft):	254.95	GWL Date:	07/19/07
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
137386.064	573779.166	02/50	655.22 ft	278	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.5	8 5/8	8	5/16	2.5	278

Borehole Notes:

Log Data Reports for this borehole have been previously issued in December 2001 and August 2006 (DOE-EM-GJ1302-2006). This report is an update based on additional logging conducted in August 2007. In addition to spectral gamma logging, moisture data were also acquired. Moisture data were also collected in 2006. Passive neutron log data were acquired in 2007 to determine if a neutron flux was detectable from potential alpha-neutron (α,n) reactions with light elements or from spontaneous fission of even numbered uranium isotopes.

GWL has changed from 252.9 ft in March 2000 to 254.8 ft on August 4, 2006; it was measured at 254.95 ft in 2007. The total depth of the borehole is reported to be 278 ft. The maximum log depth achieved in 2001, 2006, and 2007 was 274, 269.61, and 271.3 ft, respectively.

In 1992, a gross gamma log showed an interval of relatively high total counts between log depths of approximately 230 and 242 ft. On the basis of these data, the RLS was used to collect stationary measurements for 300 seconds at 236 and 252 ft. Co-60 was detected at both depths at less than 3 pCi/g. No evidence of U-235/238 or other manmade radionuclides were reported. Groundwater contamination was first reported in borehole 299-E33-18 in 1994. In 1997, the borehole was re-logged with the RLS. In addition to Co-60, U-235/238 were also detected in the vadose zone. Baseline data were collected with the SGLS in November, 2001. Comparison of the 2001 SGLS results with the 1997 data suggested the Co-60 is relatively stable, but the U-235/238 concentrations appear to increase between 1997 and 2001. These geophysical log data in 299-E33-18 and surrounding boreholes were evaluated in the waste site summary report for the 216-B-8 Crib and Adjacent Sites (GJO-2002-343-TAR) and in a later report on the B/BX/BY waste management area that was not issued. Available data indicate that manmade uranium appeared in the deep vadose zone at borehole 299-E33-18 between 1992 and 1997, and that concentrations appear to have increased between 1997 and 2001 and between 2001 and 2006. The current logging effort is made to re-log the entire borehole to assess any changes that may have occurred in uranium concentrations since 2006.

Spectral Gamma Logging System (SGLS) Equipment Information:

Logging System:	Gamma 4E		Type:	SGLS (70%) SN: 34-TP40587A
Effective Calibration Date:	05/17/07	Calibration Reference:	HGLP-CC-015	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Neutron Moisture Logging System (NMLS) Equipment Information:

Logging System:	Gamma 4H	**Type:**	NMLS SN: H310700352
Effective Calibration Date:	11/22/06	**Calibration Reference:**	HGLP-CC-002
		Logging Procedure:	HGLP-MAN-002, Rev. 0

Passive Neutron Logging System (PNLS) Equipment Information:

Logging System:	Gamma 4H	**Type:**	PNLS SN: H310700352
Effective Calibration Date:	N/A	**Calibration Reference:**	N/A
		Logging Procedure:	HGLP-MAN-002, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat	5 Repeat
Date	07/19/07	07/20/07	07/23/07	07/23/07	07/24/07
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	100.0	271.0	127.0	271.0	257.0
Finish Depth (ft)	3.0	126.0	99.0	235.0	257.0
Count Time (sec)	100	100	100	200	1000
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A[2]	N/A	N/A	N/A	N/A
Pre-Verification	DEF91CAB	DEG01CAB	DEG11CAB	DEG11CAB	DEG21CAB
Start File	DEF91000	DEG01000	DEG11000	DEG11029	DEG21000
Finish File	DEF91097	DEG01145	DEG11028	DEG11101	DEG21000
Post-Verification	DEF91CAA	DEG01CAA	DEG11CAA	DEG11CAA	DEG21CAA
Depth Return Error (in.)	- 0.25	- 1.5	N/A	- 1.5	N/A
Comments	Fine-gain adjustment after files -074, -086	No fine-gain adjustment	No fine-gain adjustment	No fine-gain adjustment	1000 s count time

Log Run	6 Repeat	7			
Date	07/24/07	07/24/07			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	236.0	236.0			
Finish Depth (ft)	236.0	230.0			
Count Time (sec)	1000	200			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			
Pre-Verification	DEG21CAB	DEG21CAB			
Start File	DEG21001	DEG21002			
Finish File	DEG21001	DEG21014			
Post-Verification	DEG21CAA	DEG21CAA			
Depth Return Error (in.)	N/A	N/A			
Comments	1000 s count time	No fine-gain adjustment			

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	8	8	8	9 Repeat	
Date	07/25/07	07/25/07	07/25/07	07/25/07	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	2.5	100.0	200.0	220.0	
Finish Depth (ft)	100.0	200.0	254.5	245.0	
Count Time (sec)	15	15	15	15	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.25	0.25	0.25	0.25	
ft/min	1.0	1.0	1.0	1.0	
Pre-Verification	DH582CAB	DH582CAB	DH582CAB	DH582CAB	
Start File	DH582000	DH582391	DH592000	DH592219	
Finish File	DH582390	DH582791	DH592218	DH592319	
Post-Verification	DH592CAA	DH592CAA	DH592CAA	DH592CAA	
Depth Return Error (in.)	N/A	N/A	N/A	0	
Comments	None	Directory change	Directory change	None	

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	10				
Date	07/25/07				
Logging Engineer	Spatz				
Start Depth (ft)	235.0				
Finish Depth (ft)	240.0				
Count Time (sec)	100				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
ft/min	1.0				
Pre-Verification	DH602CAB				
Start File	DH602000				
Finish File	DH602005				
Post-Verification	DH602CAA				
Depth Return Error (in.)	- 3				
Comments	NMLS sonde without source				

Logging Operation Notes:

Logging was conducted with a centralizer on each sonde. Measurements are referenced to the top of casing. Repeat sections were collected in this borehole to evaluate the logging systems' performance.

Analysis Notes:

Analyst:	Henwood	Date:	08/01/07	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. Acceptance criteria were met.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated using the EXCEL worksheet template identified as G4EMay07.xls. A casing correction for 0.322-in.-thick casing was applied to the SGLS data. This casing thickness is the same used to correct the 2001 and 2006 data. A correction for water was applied to the data below 255 ft.

Results and Interpretations:

Manmade radionuclides detected in this borehole for the current logging event (2007) are U-238, U-235, Co-60, and Cs-137. Cs-137 is detected from the ground surface to 10 ft in depth. These detections of Cs-137 are consistent with data acquired in 1992 that indicated Cs-137 from the ground surface to 8 ft with a maximum concentration of 40 pCi/g at 3 ft. Since the logging event in 1992, the interval from ground surface to approximately 20 ft appears to have grout emplaced around the borehole casing. Because of attenuation from the grout, SGLS measurements for Cs-137 indicate much lower concentrations of approximately 1 pCi/g.

Cs-137 is also detected at the bottom of the borehole at approximately 270 ft. Of all the logging events (1992, 1998, 2001, and 2006) in this borehole since 1992, this is the first detection of Cs-137in the deep vadose zone or below groundwater. Past data were acquired at 100 second counting times or less which may not have been sufficient to accumulate enough counts to exhibit a full energy peak. Log data were not acquired in 2006 at this depth so that a comparison could be made; logging was terminated at 269 ft. Because the Cs-137 662 keV energy peak is evident in 3 consecutive depth intervals, it is considered a valid detection. It is hypothesized that the Cs-137 is a remnant of historical (i.e., 1950's) groundwater contamination) and is not related to the influx of uranium that has been evident since 1992.

Evidence of processed uranium (U-238 and U-235) exists from 232 to 264 ft and near 270 ft. U-238 concentrations are determined by the Pa-234m energy peak at 1001 keV. U-235 is directly measured by the 185.72 keV energy peak. The maximum concentrations for U-238 and U-235 are approximately 1532 and 137 pCi/g, respectively at 235.5 ft.

Co-60 is detected between 232 and 264 ft at a maximum concentration of approximately 0.9 pCi/g at 241 ft.

Moisture logging results indicate a grout surface seal from the ground surface to approximately 20 ft. From 20 ft to 218 ft some variation in moisture is evident and moisture content ranges between approximately four and ten percent. From 219 to approximately 238 ft, a significant increase in moisture content to near saturation (e.g., approximately 20 to 40 percent) is evident. The driller's log reports a "clay" from 210 to 239 ft, roughly consistent with the high moisture. Below 239 ft, moisture remains relatively high (10 to 25 percent) until groundwater is reached at approximately 255 ft. The highest moisture content appears at the same depths as the highest uranium concentrations. The moisture data acquired in 2007 is very consistent with the 2006 data, indicating no significant changes.

The naturally occurring KUT log data indicate potential fine-grained sediment layers that may act as "perching" horizons. For example, the K-40 and Th-232 profiles suggest a relatively thick fine-grained interval from 238 to 246 ft. The driller's log refers to these sediments as "coarse sand and some clay." This interval lies just below the sediments that exhibit the highest moisture content. A Th-232 increase at approximately 264 ft appears to indicate a lithology change that coincides with the lowest depth extent of contamination. The driller's log refers to "lava rock" at this depth.

Comparisons of spectral gamma log data of manmade radionuclides acquired in 1992, 1997, 2001, 2006, and 2007 are included in the table below and a plot. The uranium data in the table are the maximum concentrations reported in the respective years.

	YEAR MAXIMUM CONCENTRATIONS REPORTED				
	1992	1997	2001	2006	2007
U-238	None detected	439 pCi/g	623 pCi/g	1237 pCi/g	1532 pCi/g
U-235	None detected	25 pCi/g	51 pCi/g	104 pCi/g	137 pCi/g

In 1992, no uranium was detected. Co-60 was detected at a few depths where stationary measurements were made to document the existence of Co-60 at less than 3 pCi/g. Continuous logging at consecutive depth intervals, as conducted in subsequent logging events, was not performed in 1992. Between 1992 and 1997, an influx of uranium was detected from 235 to 252 ft. Uranium concentrations continued to increase in 2001, 2006 and 2007. The uranium also is detected deeper in the vadose zone for each subsequent logging event and continues to appear to reach groundwater.

The manmade uranium appears to be associated with a moisture anomaly. It is postulated that some or all of the observed uranium may be dissolved in the pore fluid, and is migrating in a perched zone just above the groundwater level.

Co-60 concentrations after correction for decay indicate possible increases between 232 and 242 ft in depth since 1992 but appear stable since 2006.

The passive neutron log indicated no significant neutron flux that may be created by spontaneous fission of uranium isotopes or from alpha-neutron reactions with light elements; no plot is provided.

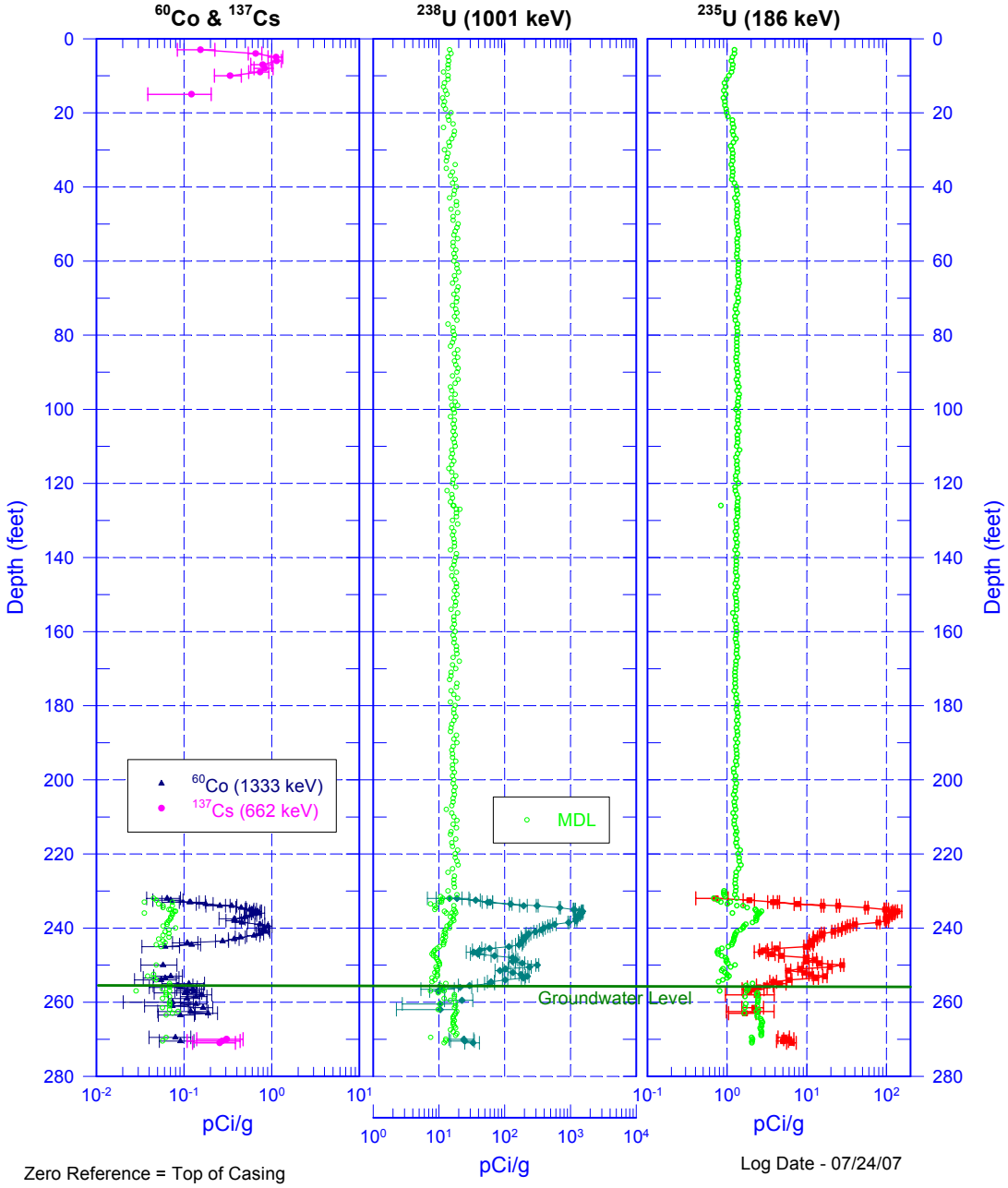
The repeat sections for the SGLS and NMLS indicate good agreement for the naturally occurring and man-made radionuclides.

List of Plots:

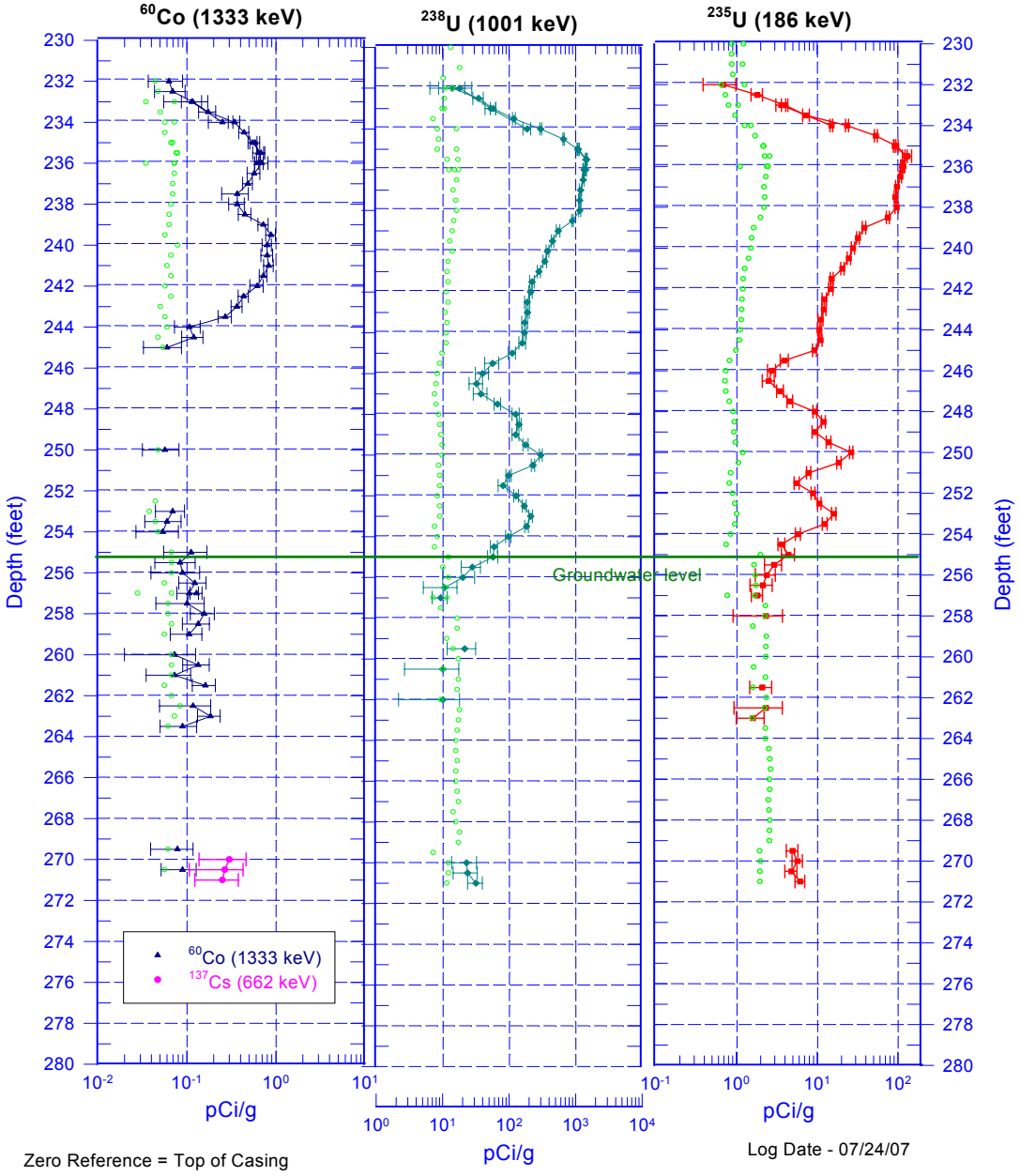
Man-Made Radionuclides (0-280 ft)
Man-Made Radionuclides (230-280 ft)
Natural Gamma Logs (0-280 ft)
Combination Plot (0-280 ft)
Combination Plot (230-280 ft)
Total Gamma & Moisture (0-280 ft)
Comparison of Manmade Radionuclides (1992 to 2007) (230-250 ft)
Comparison of Manmade Radionuclides (1992 to 2007) (240-270 ft)
Repeat Section for Man-Made Radionuclides
Repeat Section of Natural Gamma Logs
Repeat Section for Total Gamma & Moisture

[1] GWL – groundwater level
[2] N/A – not applicable

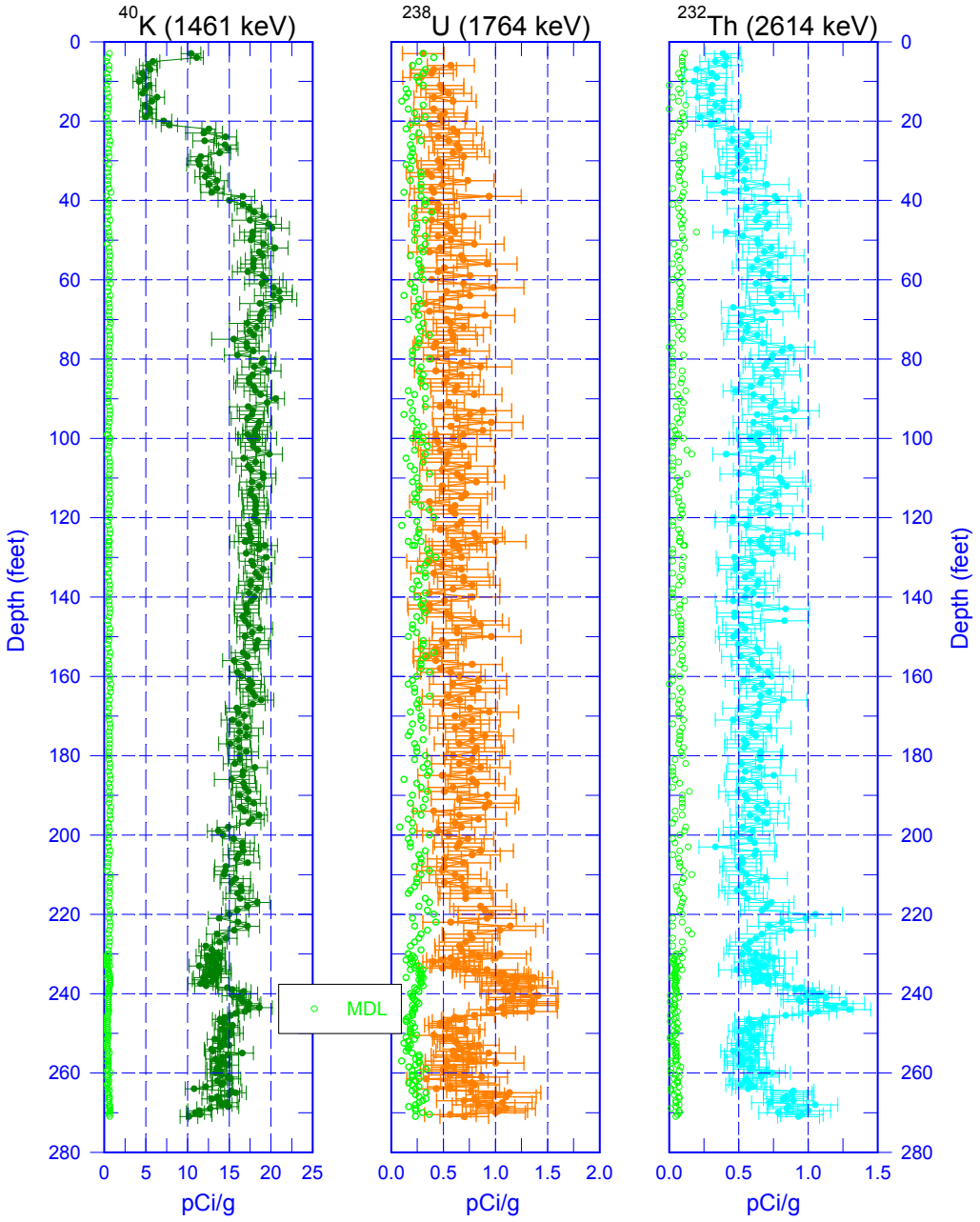
299-E33-18 (A4844)
Man-Made Radionuclides



299-E33-18 (A4844)
Man-Made Radionuclides



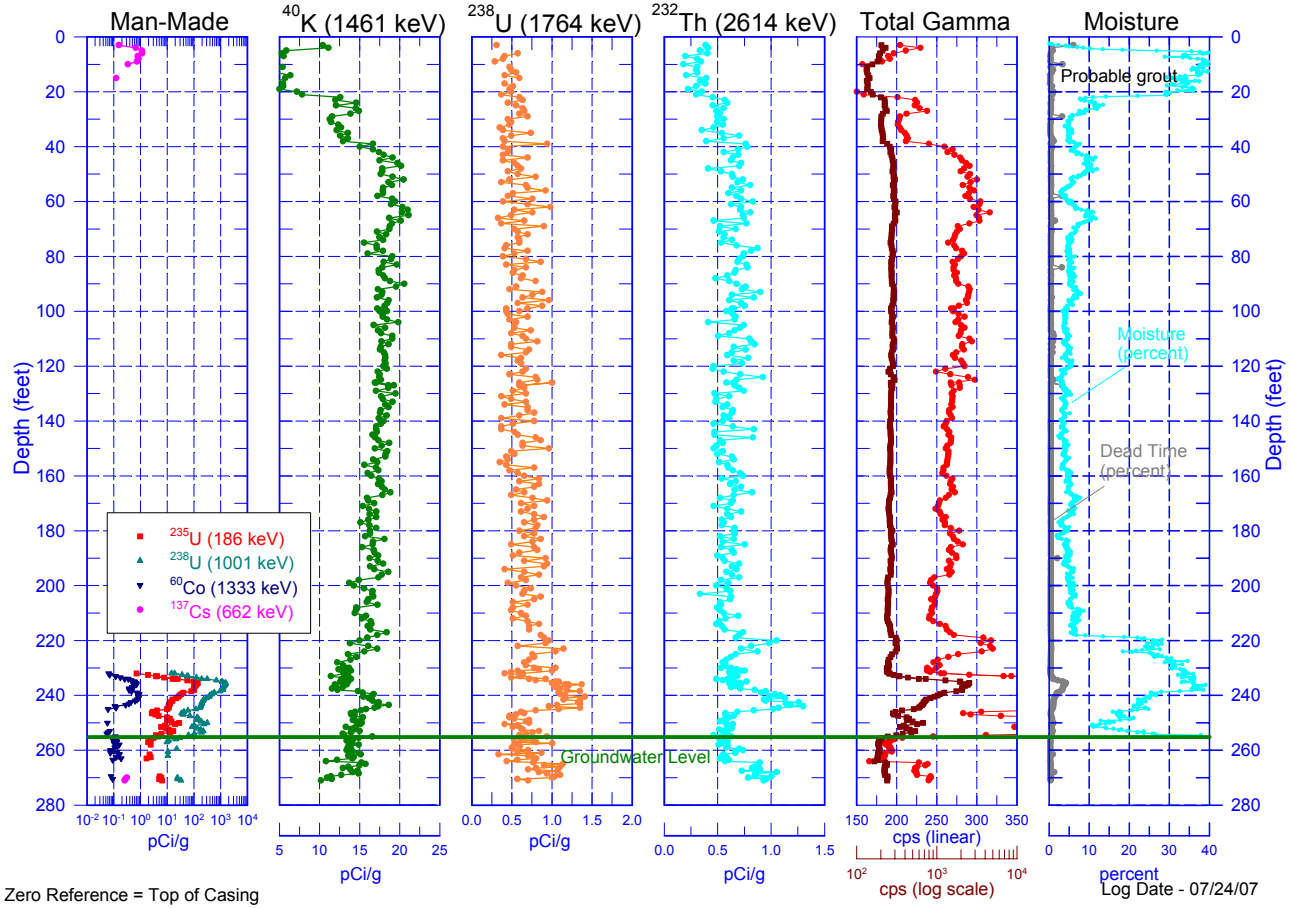
299-E33-18 (A4844)
Natural Gamma Logs



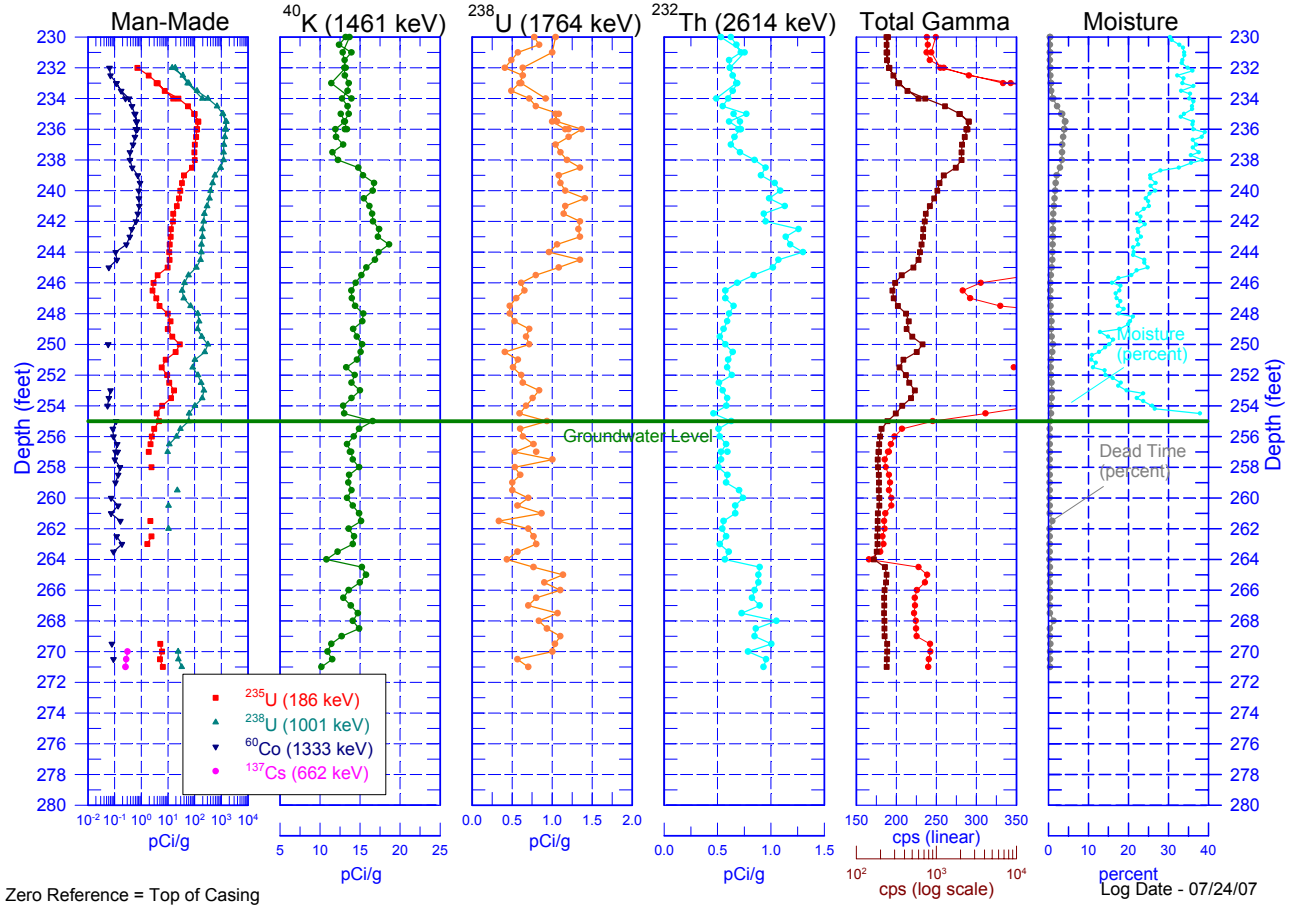
Zero Reference = Top of Casing

Log Date - 07/24/07

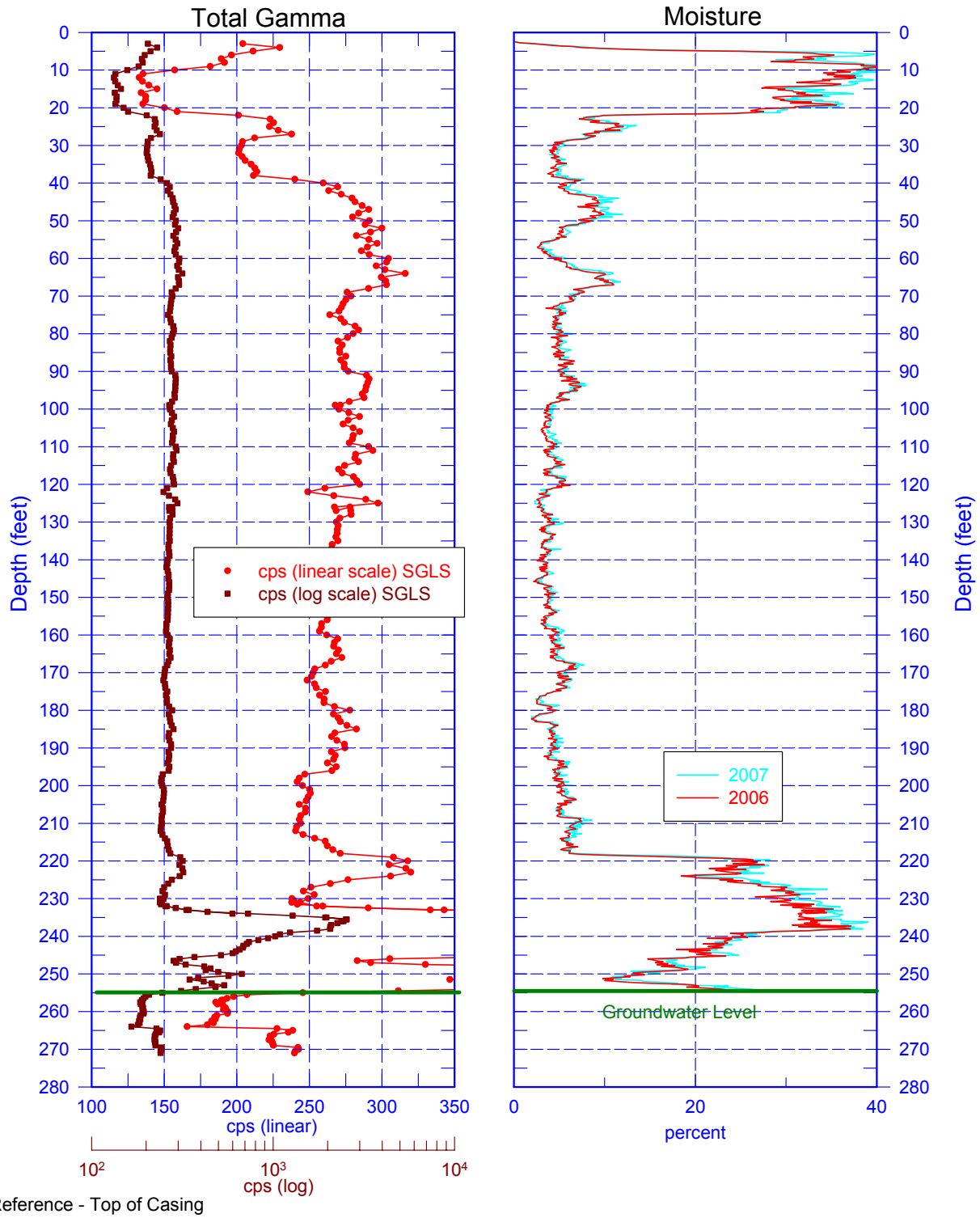
299-E33-18 (A4844) Combination Plot



299-E33-18 (A4844) Combination Plot

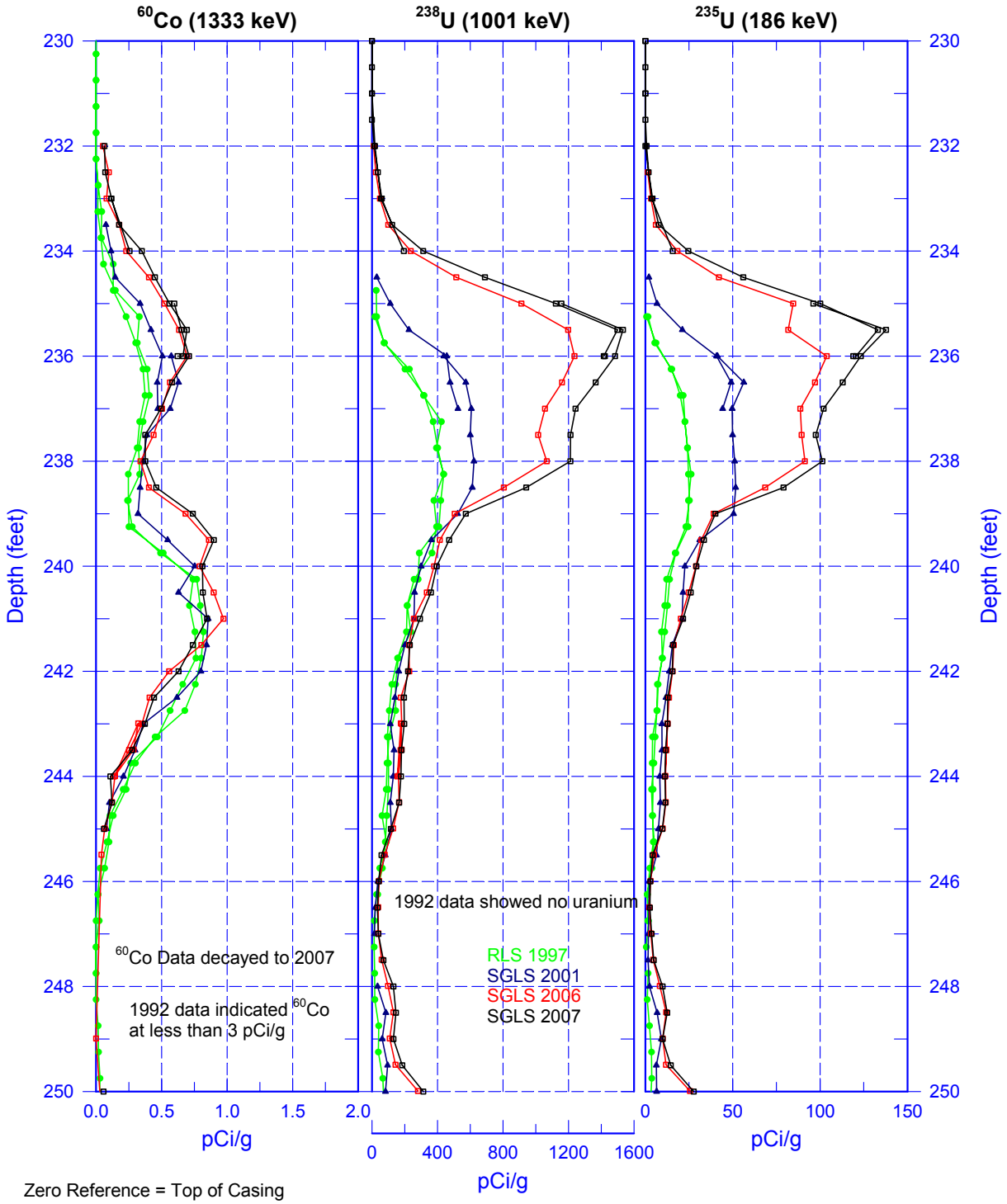


299-E33-18 (A4844)
Total Gamma & Moisture



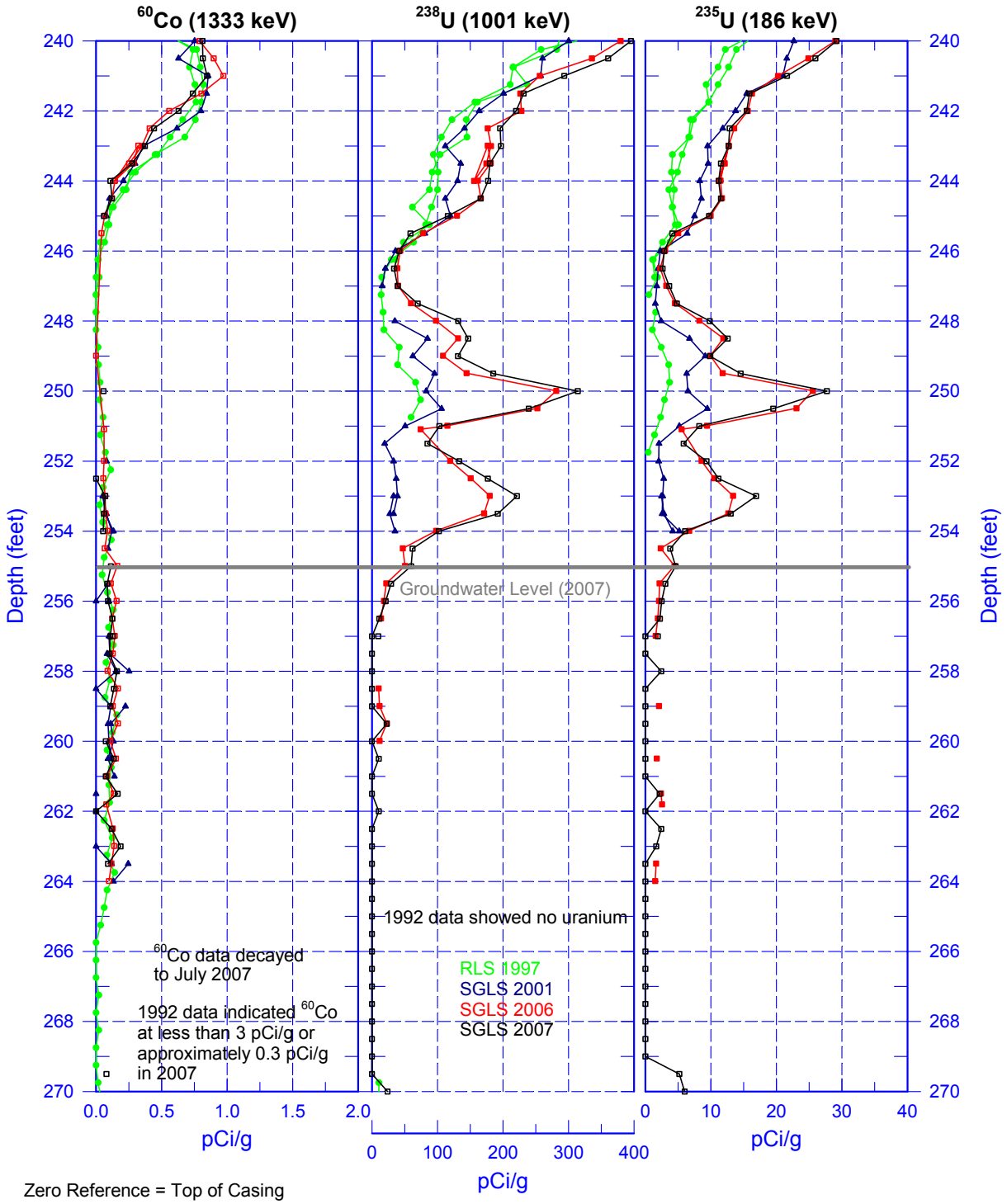
Reference - Top of Casing

299-E33-18 (A4844)
Comparison of Man-Made Radionuclides (1992 to 2007)



Zero Reference = Top of Casing

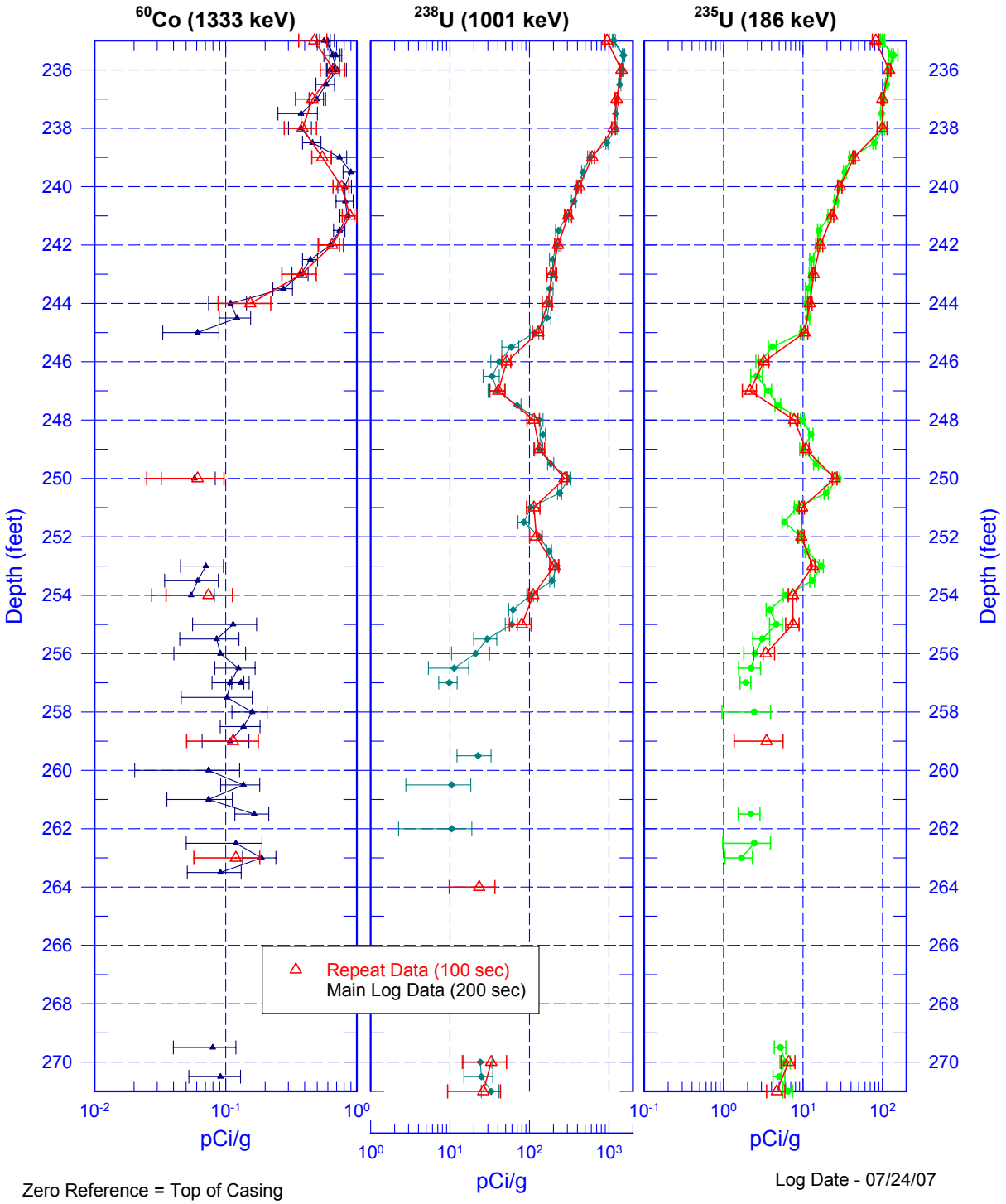
299-E33-18 (A4844)
Comparison of Man-Made Radionuclides (1992 to 2007)



Zero Reference = Top of Casing

299-E33-18 (A4844)

Repeat Section for Man-Made Radionuclides

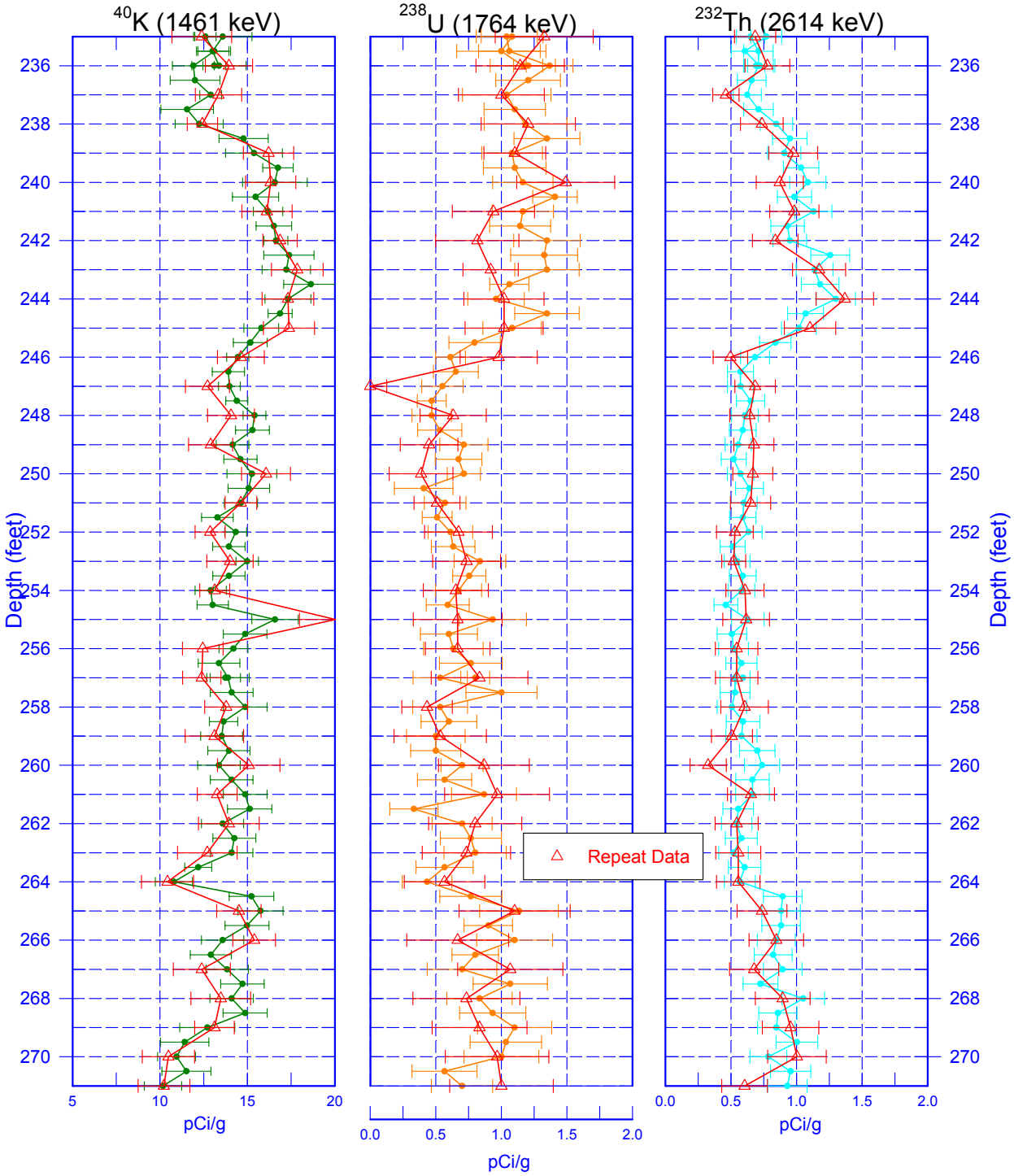


Zero Reference = Top of Casing

Log Date - 07/24/07

299-E33-18 (A4844)

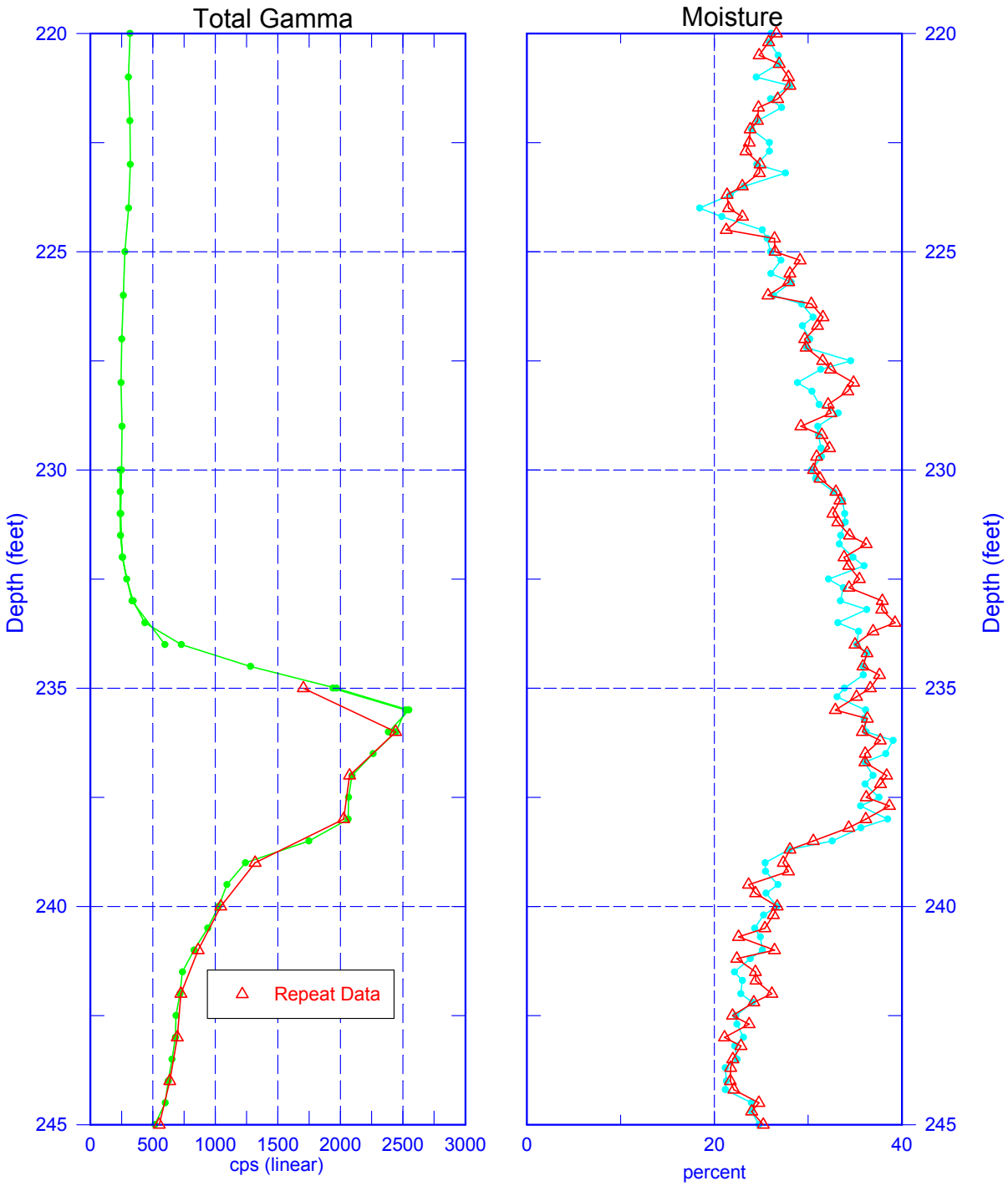
Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing

Log Date - 07/24/07

299-E33-18 (A4844)
Repeat Section for Total Gamma & Moisture



Reference - Top of Casing

Log Date 07/2007